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DEPARTMENT OF REGISTRATION AND EDUCATION
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Morris M. Leighton, Chief

MT. CARROLL AREA

Carroll County

GUIDE LEAFLET 53 A C

by
Arthur C. Bevan

Urbana, Illinois
October 10, 1953

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Part I. Itinerary

0.0	0.0	Caravan assembles at Shimer College, Mount Carroll.
0.0	0.0	Leave campus and turn right (N) on Clay Street.
0.2	0,2	Jct. with Routes 64-52; turn left (W).
0.1	0.3	Stop sign. Cross Main Street and descend grade.
0.2	0.5	Road-end; turn right (N) in valley.
0.1	0.6	Park entrance. Turn left into Point Rock Park.
0.3	0.9	Cross bridge and park along roadside.

STOP NO. 1. Walk east to Point Rock. This is an outcrop of Galena Dolomite (magnesian limestone) of Ordovician age.

Beneath the surface soils of the Mount Carroll region is a considerable thickness of loose material (gravel, sand, clay, etc.), most of which was dumped here at the time of the melting of the Illinoian glacier. Beneath this "glacial drift" lies bedrock of great age. The bedrock is exposed chiefly in those places where erosion by streams during or since the Ice Age has cut down through the glacial drift cover.

Farther north in the region, Niagara (Hopkinton) dolomite of Silurian Age lies beneath the drift, but in the south part of the area, older, Ordovician dolomites form the bedrock surface. This is because the strata in the south have been uplifted several hundred feet to form the so-called Savanna anticline (up-fold).

The Galena Dolomite is over 200 feet thick. The even stratification of the layers indicates that the rock was deposited in quiet water, and the fossils in the dolomite indicate a marine environment. White chert (SiO_2) is characteristic of much of the formation. The Galena Formation takes its name from Galena, Illinois, which in turn is named after the valuable lead sulphide (galena), which occurs in association with zinc minerals in the Galena region.

0.0	0.9	Continue ahead, turn at end of parkway, and return to --
0.6	1.5	Park exit. Turn right (S).
0.1	1.6	Turn left (E) and ascend grade to --
0.1	1.7	Main Street; turn left (N).
0.1	1/8	Stop sign. Continue ahead (N) across Franklin Street.
0.3	2.1	Turn right (E) along south side of Court House.
0.1	2.2	Stop sign. Turn left (N) on Clay Street (Route 78) and park caravan. Walk north to bridge over gorge of Carroll Creek.

STOP NO. 2. Here is seen a much greater thickness of Galena Dolomite, rising close to the top of the gorge wall (about 780 feet A.T.).

The Illinoian ice mass and the glacial drift it left behind masked the former drainage pattern of ridges and valleys. Commonly, the streams that reappeared after the glacial retreat found the old, buried valleys. But here the post-glacial stream cut down to discover a former rock ridge. This evidently served temporarily as a dam, at a time when the stream was swollen with water from the melting ice that still existed to eastward. As a result gravels washed out from the ice were deposited along the broad valley up stream. Very likely a water fall existed on the site of the present rock gorge, which eventually developed as the falls retreated up stream.

0.0 2.2 Continue ahead (N) on Route No. 78.

2.7 4.9 Descend grade and park adjacent to quarry on right.

STOP NO. 3. The quarry exposes nearly 30 feet of Silurian dolomite of Niagaran (Hopkinton) age. The top of the quarry lies at an elevation of about 730 feet above sea level, which is some 50 feet lower than the Galena outcrop top in Mt. Carroll. To reach this same Galena dolomite at the present stop, it would be necessary to bore down over 250 feet. Such structural differences in a very short horizontal distance are relatively rare in northern Illinois. Evidences of faulting may be found along this same line in the Savanna area, but the fault may have passed into a very steep down-fold ("monocline") farther east.

Near the bottom of the quarry and again across the middle are two bands of thick-bedded dolomite jammed with the casts and molds of a large brachiopod, Pentamerus oblongus. The original shell matter has been dissolved away, and only the impressions in the rock are left behind. Between the upper and lower shell bands, which may be likened to present-day oyster colonies, the Pentamerus is less common and is associated with a smooth, transversely elliptical brachiopod (Stricklandia sp.). The upper 7 feet of rock in the quarry is more granular and porous, lacks the brachiopods mentioned, and contains, rarely, a peculiar, golf ball-like coralloid fossil, Cerionites dactyloides.

The Pentamerus bands, with the Cerionites bed above, extend continuously in this part of the Niagaran throughout northwestern Illinois and northeastern Iowa. Rocks of similar age in northeastern Wisconsin, upper Michigan, and western New York also have two Pentamerus bands with an interval between. The Cerionites has not been found farther to the east, however.

0.0 4.9 Continue ahead (N) on Route 78.

1.3 6.2 Exposures of Silurian, Edgewood and Kankakee dolomites, of Lower Silurian age are here exposed at elevations below that of the Middle Silurian (Niagaran) beds of Stop No. 3.

0.1 6.3 Cross Plum River.

0.8 7.1 Outcrops of Lower Silurian dolomite on right.

0.3 7.4 Cross creek.

0.5 7.9 STOP NO. 4. Park along roadside and walk east into gravel pit.

When the Illinois glaciers melted, they dropped the rock, sand, and clay picked up at many points along the 1000 mile course and dropped them as an unsorted blanket of earth and rock called "glacial till". Such unsorted glacial till may be seen forming the upper 7 feet of the pit.

When a glacier melts, it also releases immense quantities of water. When water encounters unsorted material (such as glacial till) a sorting action takes place. The heavy boulders are dropped close to the source, sand and gravel are deposited as bars and banks along the courses of the streams, and the silt and clay are carried off long distances to be deposited in slack waters.

The lower 20 feet of deposits in the gravel pit illustrate water-laid glacial deposits, and show stratification and a removal of most of the clay and silt. That the waters were highly turbulent is shown by the presence of large boulders and of fragments of limestone torn from the local ledges. That the deposit was laid down during the glacial period is evidenced by the large numbers of igneous (granite, gabbro, basalt, porphyry) and metamorphic (schist, gneiss, quartzite) rocks which crop out many hundreds of miles to the north, in the region of Lake Superior and Canada.

It is probably that the gravel was laid down just ahead of the advancing ice, where torrential floods of melt water existed in the summer season. That the ice eventually covered the gravel deposit is shown by the presence of the till above it. However, it did not advance far as we are here within a mile of the west limit of glaciation.

At the same level as the gravel, Lower Silurian strata are present just northwest of the pit. This shows that the gravel was deposited in the head of a small preglacial valley.

0.0 7.9 Continue ahead (N) on Route 78; the route for the rest of the morning will be in the "Driftless Area", which was not covered by glacial ice.

1.6 9.5 STOP NO. 5. Park along ridgetop on roadside south of intersection from east. Walk north and descend hill along highway.

The highly cherty, thin-bedded dolomite strata of Lower Silurian (Alexandrian) age are exposed in the cut at the top of the highway grade. Small fossils are rather sparsely present in the chert as well as the "honey-comb" coral, Favosites.

The top of the Lower Silurian ledges lies at about 800 feet, reflecting the slow rise of the strata to the north, between Stops 3 and 5. This northward rise of the rock layers continues far into Wisconsin, so that farther north the Galena dolomite again comes to the surface and eventually the ancient Pre-Cambrian "granite basement" is exposed.

0.0 9.5 Continue ahead (N) on Route 78.

2.9 12.4 PLEASANT VALLEY.

1.1 13.5 Town Hall on right.

1.0 14.5 Turn left (W) on side road and cross Plum River (West Branch).

1.1 15.6 Turn left (W) at school house in ELMOVILLE.

1.5 17.1 Forks. Go right on road marked "Massbach".

1.5 18.6 Montrose School on left.

0.5 19.1 Intersection. STOP NO. 6. Remain in cars. Between the school house and the intersection, route travels over ridge summit at an elevation above 1020 feet. Because all of the country within view is part of the unglaciated area, it preserves the appearance which much of Illinois had before the coming of the glaciers. The region is in the mature stage of the erosion cycle; that is, it is well drained, in a dendritic pattern, and the area of the ridge tops about equals the area of the valleys.

Although the region is dissected to a rough, hilly terrain as a result of stream erosion, the ridges all rise to about the same height, to produce a level horizon. The 1000 foot ridge top level is the remnant of a former peneplain. This was a plain of erosion developed at a time in the past when the region lay close to sea level and the streams could no longer deepen their valleys. Their activity, confined to lateral cutting, eventually reduced all of the region to a nearly level plain.

Later, perhaps not long before the Ice Age (Pleistocene), the region rose many hundreds of feet and the streams were once again able to resume downward cutting, to produce the rough country we see today. If sea level does not change in the interim, a new peneplain will in time develop at or below the level of the present valley floors.

0.0 19.1 Turn ~~left~~ right (NE) at intersection. Route is through picturesque Driftless Area country back to Route 78 and Stockton.

2.6 21.7 STOP NO. 7. Remain in cars.
The splendid view to the northwest overlooks the Apple River country, in the direction of Charles Mound, the highest point in Illinois (1241'). We are standing on the northwest edge of the Silurian escarpment, beyond which erosion has removed the Silurian rocks, except for isolated remnants, called "outliers". Once the outliers were connected with the parent escarpment and the Silurian dolomite existed as a continuous formation over all of northwestern Illinois.

The low lands, between the outliers, are floored with Ordovician, Galena Dolomite, the same formation seen at stops 1 and 2, far to the south. Were it not for the structural uplift along the Savanna-Mt. Carroll-Lanark anticline, the Galena would not be again exposed south of the area now in view.

2.0 23.7 Road intersection. Turn left (N).

1.0	24.7	Road end. Turn right (E) at Stockton Center School.
1.1	25.8	Road intersection; continue ahead (E).
0.5	26.3	DANGER. Stop sign. Turn left (N) on Route 78.
1.2	27.5	Enter STOCKTON.
0.5	28.0	Park on east side of highway, north of Standard Filling Station in Stockton. LUNCH STOP. Reassemble at this point in one hour.
0.0	28.0	Drive to right around block and return south through Stockton on Route 78.
0.5	28.5	Leave Stockton.
1.4	29.9	Galena dolomite outcrop on left.
4.0	33.9	Cross Plum River.
2.7	36.6	Turn left (NE) at Pleasant Valley Town Hall.
2.8	39.4	Intersection at School House; continue ahead (NE).
2.7	42.1	Intersection at Willow School; continue ahead (E) on minor road.
0.5	42.6	Road is floored by ledges of Lower Silurian, Kankakee dolomite. Bare rock on ridge tops indicates unglaciated area, as does splendid view of summit peneplain and maturely dissected terrain.
0.6	43.2	Side road from right; continue ahead (E).
0.6	43.8	Road intersection; continue ahead (E).
0.7	44.5	Road turns right (S).
0.2	44.7	Road turns left (E).
0.2	44.9	Forks; go right; road travels over white chert in red clay, a result of the residual weathering of the cherty Kankakee dolomite. Road turns left (E) and descends hill.
0.3	45.2	Junction with main road from left; continue ahead (E).
0.2	45.4	Turn right (S) just short of bridge.
2.2	47.6	Church and cemetary. Turn left (E) and join blacktop
0.4	48.1	Bridge over East Plum River. STOP NO. 8. Remain in cars. The ledges in the creek just north of the bridge represent the top (Dubuque Member) of the Galena Formation. By comparison with the level water surface, it can be seen that the strata incline slightly to the south. This dip causes the Galena to disappear beneath the floor of the valley south of here, and to not reappear until brought to the surface by the uplift at Mt. Carroll.

0.0 48.1 Continue ahead (E) up grade.

0.3 48.3 STOP NO. 9. Park along roadside.
In the right hand road ditch and cut, blue shale with thin-bedded limestone is exposed. Some limestone layers are covered with brachiopod shells, bryozoa (see appendix plate) and other fossils. Similar fossils occur free in the shale. The fossils and the nature of the rock indicate it to belong to the Brainerd (uppermost) member of the Maquoketa formation.

This shale formation of late Ordovician age, lies between the hard dolomites of the Galena below and the Silurian (Edgewood, Kankakee, and Hopkinton) above. Because it is weak, it tends to make gentle slopes between the upper and lower dolomite escarpments. Although the formation has been crossed numerous times during our itinerary, this is the first place at which it was found to be exposed. Even such exposures tend to be transient.

0.0 48.3 Continue ahead (E) and ascend grade to ridge summit, capped by Silurian dolomite.

3.6 51.9 DANGER. Stop sign. Turn right (S) on Route No. 73.

3.5 55.4 Along creek to left, Maquoketa Shale is exposed in creek bed and basal layers of Silurian limestone in creek bank. (Ordovician-Silurian contact about 810')

2.7 58.1 DANGER. Stop sign. Continue ahead on Route No. 72.

1.0 59.1 Turn right into quarry.

STOP NO. 10. Quarry in Niagaran, Hopkinton Dolomite. Here as at Stop No. 3, we find the upper Pentamerus band (low in the quarry), upon which rests the Cerionites bed. The latter is here much more fossiliferous than at No. 3 and has, in addition to Cerionites dactyloides, numerous brachiopods (Pentamerus maquoketa, Leptaena rhomboidalis, Atrypa reticularis, etc.), as well as gastropods (snails) and other mollusks. The organ pipe coral (Syringopora) occurs as casts of the tubules, in both beds.

The upper Pentamerus oblongus band is 8 feet thick and splendid large specimens are found at its base.

The Cerionites beds are 12 feet thick and are overlain by rough weathering strata full of Favosites (Honey Comb coral) Halysites (Chain coral), and other corals. At least 13 feet of these coralline strata are exposed. Similar coral beds overlie the Cerionites zone in Iowa, and are found in northeastern Wisconsin (Upper Coral Beds), upper Michigan (Cordell Formation) and on Manitoulin Island in Lake Huron.

It is by means of the recognition of similar successions of fossils zones that geologists are able to determine the contemporaneity of formations over widely separated regions.

From the point at which we turned south onto Route 73, the rock layers have shown a steady but very gentle southward descent. However two miles southwest of the quarry, Galena dolomite crops out along a creek at about the same elevation as we are here (850'). This represents an uplift of over 300 feet in so short a distance, and a return to the Savanna-Mt. Carroll-Lanark uplift on which the trip began.

End of Conference

To return to Mt. Carroll via Routes 52-64, go south 3-1/4 miles through Lanark on Route 72 and turn right (W).

To go to U. S. Route 20, Galena, Freeport, and Rockford, turn north on Route 72.

GEOLOGICAL HISTORY OF MOUNT CARROLL AREA

DEEPLY BURIED FORMATIONS

The oldest bedrock strata known to come to the surface in the Mt. Carroll area belong to the Prosser Dolomite Member, Galena Formation, of Ordovician Age. A deep water well drilled at Savanna shows that older dolomite, sandstone and shale of Ordovician Age lie below the Galena Dolomite here (see well record in appendix), and that still older Cambrian strata lie below the Ordovician rocks.

From evidence of deep wells in other parts of Illinois, and from studies in Missouri, Wisconsin and Minnesota, we know that below the stratified Cambrian sandstone, limestone and shale is rock of quite a different nature which, for convenience, we here refer to as the granite basement of Pre-Cambrian age.

PRE-CAMBRIAN BASEMENT

Actually this basement or foundation, upon which the stratified deposits of the ancient Paleozoic seas were laid down, has had a long, complex and violent history. It involves the first three-fourths of all geologic time (roughly 2,000,000,000 years). During this time, high mountain ranges were upraised, molten rock matter was injected into the strata deep in the crust or spewed out on the surface as lava, the stratified rocks were twisted, shattered and partly remelted, and between these periods of violence, the forces of erosion had time to wear the mountains to nearly level plains. These periods of erosion and of mountain building (diastrophism) alternated several times during the billion and one-half years of Pre-Cambrian time, terminating with a final period of erosion that carved the level peneplain of the "granite basement" surface.

The rocks which make up this foundation are all of hard crystalline types. Some, such as granite, gabbro, porphyry and basalt, cooled from a molten state, either deep below the surface (intrusions) or as lava outpourings (extrusions). Sedimentary rocks which were originally shale, limestone or marble were transformed by heat and stress into "metamorphic" rocks like gneiss, schist, marble and quartzite.

PALEOZOIC SEAS

The long period of erosion and peneplanation that closed pre-Cambrian time came to an end when the Cambrian seas spread over the region some 500,000,000 years ago to begin the deposition of the layered bedrock formations. Similar seas persisted here through most of Paleozoic time. Thus the marine deposits of the Cambrian, Ordovician and Silurian periods are still to be found in the Savanna region. The Devonian limestones were certainly once present but have been removed by erosion, and Mississippian and Pennsylvanian strata may also once have existed here. The teeming life of some of these ancient Paleozoic seas is amply attested by rich fossil beds, such as visited on this trip.

LONG INTERVAL OF EROSION

After the last of the Paleozoic seas left this region, it was uplifted a moderate distance above sea level; and so it has remained ever since. Thus, during the Mesozoic days of the dinosaurs and during all Tertiary time that followed (a time span totalling about 250,000,000 years), weathering penetrated deep into the bedrock, and streams carved the landscape into a pattern of valleys and ridges. At times the whole region would be reduced to base level. Such a condition arises when the land surface has been cut down to a near-plain close to the level of the sea. It seems to have taken place at least twice during the long-time span between the Carboniferous and the Ice age, as indicated by erosional terraces on the present uplands.

The higher of these terraces, the Dodgeville peneplain, is not preserved in the Mt. Carroll area, but the lower, or Lancaster, level bevels the flat ridge tops of the Carroll County uplands. It is believed to have developed in the latter part of the Tertiary period, before the coming of the continental glaciers.

Because the region was eroding and the detritus was being carried off to be deposited elsewhere, no strata of Mesozoic or Tertiary age are known from the Savanna area.

GLACIAL PERIOD

The next deposits to be laid down in the region, following the long interval of erosion, accumulated as a result of the glacial invasions which began about a million years ago. Of the four main continental glacial advances of the Pleistocene period, only the third, or Illinoian, entered the Mount Carroll area. This ice mass spread southward and westward from a center of accumulation east of Hudson Bay. It covered nearly all of Illinois, but in the northwest, stopped along a line running from south of Savanna to just west of Mount Carroll and just east of Stockton.

In addition to the glacial till and water laid glacial deposits, there was laid down over the uplands a blanket of fine silt, called loess. This was dust picked up by the Ice Age gales along the alluvial flats of great rivers like the Mississippi and dropped over the uplands. The deposits are thick close to the Mississippi, as near Savanna, and thin rapidly away from the river.

Today streams continue to deposit alluvium over their flood plains and man, in his agriculture and his engineering speeds the unceasing erosive activity of Nature.

For further information, consult:

"Physiographic Divisions of Illinois," Leighton, Ekblaw & Horberg, Report of Investigations No. 129, Illinois State Geological Survey.

"Bedrock Topography of Illinois," Horberg, Bulletin No. 73, Illinois State Geological Survey.

"Geology of the Galena and Elizabeth Quadrangles," A. C. Trowbridge, Bulletin No. 26, Illinois State Geological Survey.

GENERALIZED GEOLOGIC COLUMN FOR MOUNT CARROLL AREA

ERAS		PERIODS	EPOCHS	REMARKS
Cenozoic "Recent Life"	Age of Mammals	Quaternary	Pleistocene	Peorian Loess. Illinoian glacial drift. Alluvium in river valleys.
		Tertiary	Pliocene Miocene Oligocene Eocene Paleocene	Not present in Carroll County.
Mesozoic "Middle Life"	Age of Reptiles	Cretaceous		Present only in extreme southern Illinois.
		Jurassic		Not present in Illinois.
		Triassic		Not present in Illinois.
Paleozoic "Ancient Life"	Age of Amphibians Early Plants	Permian		Not present in Illinois.
		Pennsylvanian		Not present in Carroll County.
		Mississippian		Not present in Carroll County.
	Age of Fishes	Devonian		Not present in Carroll County.
	Age of Invertebrates	Silurian	Cayugan	Not present in this area.
			Niagaran	Pentamerus Beds Coral Beds
			Alexandrian	Stricklandia bed Kankakee cherty beds. Edgewood earthy dolomite.
		Ordovician	Cincinnatian	Maquoketa shale and shaly limestone.
			Mohawkian	Galena dolomite-in outcrop Decorah shale) Platteville ls.)in wells Glenwood ls.)
			Chazyan	St. Peter ss. - in wells.
			Prairie du Chien	Shakopee dolomite) New Richmond ss.)in wells Oneota dolomite)
		Cambrian		In deep wells only.
Proterozoic Archeozoic		Referred to as "Pre-Cambrian" time.		No data available.

BURIED FORMATIONS - CARROLL COUNTY

Surface 610' above sea level.

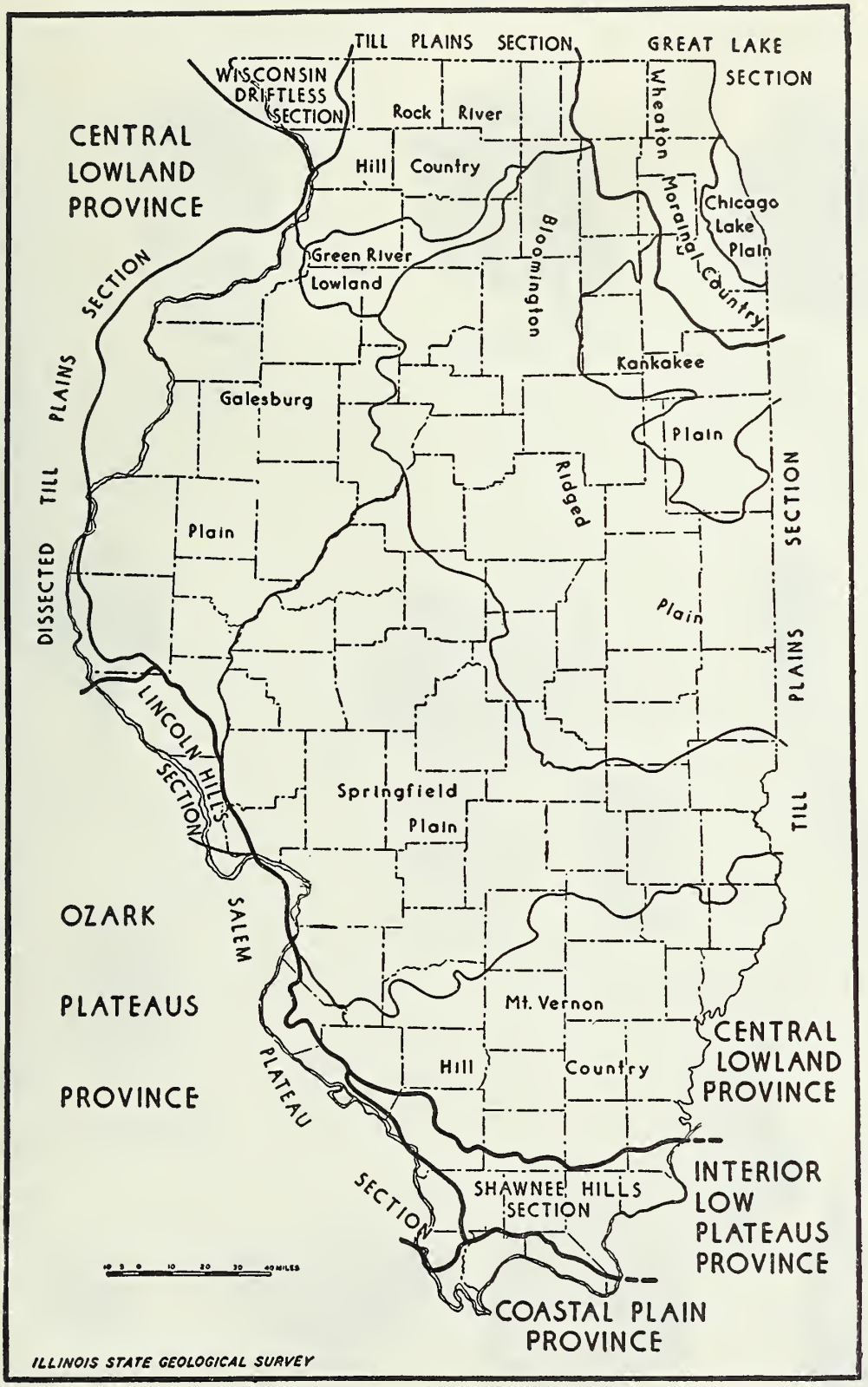
325'	Dolomite overlain by 5' of soil. Shaly beds in lower 100 feet and sandy near bottom.	GALENA - PLATTEVILLE	ORDOVICIAN PERIOD
40'	Shale and sandy dolomite	GLENWOOD	
50'	Loose, clean sand.	ST. PETER	
340'	Dolomite shaly and sandy at top. Lower 2/3 very cherty: Bottom sandy and oolitic.	ONEOTA - SHAKOPEE	
160'	Dolomite, some pink and red layers.	TREMPEALEAU	
80'	Fine glauconitic sand and sandy shale.	FRANCONIA	CAMBRIAN PERIOD
100'	Sandstone, coarse to medium; some dolomite	IRONTON - GALESVILLE	
208 +	Fine sandstone, shale, some dolomite, glauconitic.	EAU CLAIRE	

Depth 1308', or 698' below sea level.

Generalized from Savanna City deep water well, drilled, 1935, at Pine and Barren Sts.

Time Table of Pleistocene Glaciation
(after M. M. Leighton and H. B. Willman, 1950)

tages	Sub-stages	Nature of Deposits	Special Features
ecent		Soil, infant to youthful profile of weathering, lake and river deposits, dunes, peat.	
	Late Mankato Early	Fluvial deposition - Mississippi, Illinois, and Ohio river valleys; dune sand, some loess deposits along Mississippi River Valley; and deposits in Lake Chicago.	Lake Agassiz Torrent eroded Late Mankato deposits Lake Duluth Torrent eroded Early Mankato deposits Forest bed, Two Creeks, Wisconsin
isconsin 4th glacial)	Cary	Drift, loess, dunes, beginning of deposits in Lake Chicago	Kankakee and Lake Maumee Torrents
	Tazewell	Drift, loess, dunes, lake deposits.	Fox River Torrent Westward diversion of Mississippi River into Iowa by Tazewell ice lobe
	Iowan	Drift, loess, dunes	
	Farmdale (Pro-Wis.)	Loess (in advance of glaciation)	
angamon 3rd interglacial)		Soil, mature profile of weathering, alluvium, peat	
	Buffalo Hart	Drift	
	Jacksonville	Drift	
llinoian 3rd glacial)	Payson (terminal)	Drift	
	Loveland (Pro-Ill.)	Loess (in advance of glaciation)	
armouth 2nd interglacial)		Soil, mature profile of weathering, alluvium, peat.	
ansan 2nd glacial)		Drift Loess	
Ctonian 1st interglacial)		Soil, mature profile of weathering, alluvium, peat.	
ebraskan 1st glacial)		Drift	



PHYSIOGRAPHIC DIVISIONS OF ILLINOIS

(Reprinted from Report of Investigations No. 129, Physiographic Divisions of Illinois, by M. M. Leighton, George E. Ekblaw, and Leland Horberg)

COMMON TYPES of ILLINOIS FOSSILS

GRAPTOLITE

Cup coral

Lithostrotion

CORALS

Honeycomb coral

CRINOID

CYSTOID

PENTREMITE

Fenestella

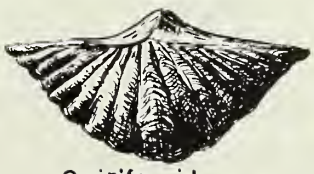
Archimedes

Branching

BRYOZOA

ingula

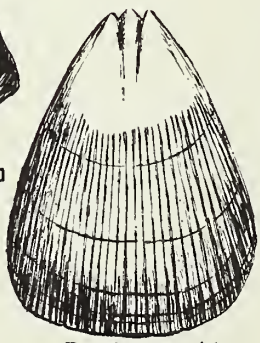
Orbiculoidea



Spiriferoid

Productoid

Composita



Pentameroid

BRACHIOPODS

M.M.C.

COMMON TYPES of ILLINOIS FOSSILS

"Clam"

"Scallop"

PELECYPODS

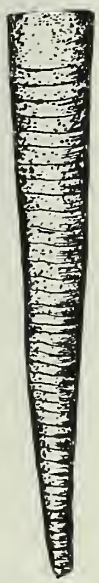
High- spired

Low - spired

Flat - spired

GASTROPODS

Curved cone



Straight cone

Coiled cone
(Nautilus)

CEPHALOPODS

Bumastus

Calymene
(coiled)

OSTRACODS
(greatly enlarged)

Calymene
(flat)

TRILOBITES

M.M.C.

GLOBE-WERNICKE

"TUFTEAR"

FOLDER

TO RE-ORDER SPECIFY

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